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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/669,063	09/23/2003	Mohamad A. Shaheen	42P15990	2742

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EXAMINER
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TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

10/669,063

**Applicant(s)**

SHAHEEN, MOHAMAD A.

**Examiner**

Binh X. Tran

**Art Unit**

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 15-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 21-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 1-26-2005.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election without traverse of Group I (claims 1-14, 21-29) in the reply filed on 5-31-2005 is acknowledged.
2. Claims 15-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 5-31-2005.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 4-7, 21-27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In claims 4 and 21, the examiner does not understand the limitation "wherein the first layer has an increasing concentration of germanium throughout a thickness of the first layer" (emphasis added). It is impossible to have an "increasing concentration" of germanium "throughout" the thickness of the first layer" (i.e. it is impossible to have a concentration increase in all directions of the thickness). If the concentration of the

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germanium is increasing in one direction of the thickness, then the concentration of germanium on the opposite direction must decrease.

Claims 5-7, 22-27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement because they directly or indirectly depend on claim 4 or claim 21.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-14, 21-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thilderkvist (EP 1 085 562 A2) in view of Leitz et al. (US 2002/0197803 A1).

Respect to claim 1, Thilderkvist discloses a method comprising the steps of:

forming a silicon germanium layer on the substrate (paragraph 0033, 0045);

removing, in the processing chamber, a portion of silicon germanium layer (exposing to etchant gas) (See paragraph 0048-0049);

smooth a surface of silicon germanium layer (i.e. heating at 1000-1300 °C) in the processing chamber (paragraph 0047);

forming a silicon layer on the smooth surface of the silicon germanium layer (Figure 1 step 108).

Thilderkvist fails to disclose that the silicon germanium is also formed in the same processing chamber. Leitz teaches to form silicon germanium in the process

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chamber. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Thilderkvist in view of Leitz by forming the initial silicon germanium layer in the same processing chamber in order to save cost, processing time on wafer handling and in order to avoid contamination during wafer handling. Further, this would also be possible with the processing chamber in Fig 2A of Thilderkvist which is suitable for layer deposition.

Respect to claim 2, Thilderkvist teaches the substrate is not removed from the processing chamber until after the silicon layer is formed (Fig 1). Respect to claim 3, Thilderkvist teaches to in the chamber under vacuum by using a pump to create reduced pressure during the removal of a portion of silicon germanium layer until after the completion of formation of the silicon layer (paragraph 0032).

Respect to claims 4, 21, Leitz discloses the step of: forming a first layer of silicon germanium (12) on a silicon substrate, wherein the first layer (12) has an increase in concentration with respect to one direction of the thickness (paragraph 0030), forming a second layer (14) of silicon germanium on the first layer (12) of silicon germanium, wherein the second layer has a constant concentration of germanium throughout a thickness of the second layer (paragraph 0030, Fig 1). It would have been obvious to one having ordinary skill in the art, at the time of invention, to form two different silicon germanium layers and etching the second layer because it will enhance the performance of the hetero-structure device by using silicon germanium as carrier mobility. The limitation of claims 22-23 has been discussed above.

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Respect to claims 5 and 24, Leitz teaches to increase the concentration of germanium in the first layer so that the concentration of germanium increases by 10% per micron of the thickness (paragraph 0030).

Respect to claims 6 and 25, Leitz discloses that the concentration of the second layer (14) is 20%. Leitz also teaches first layer has a thickness of 2-9 micron and the concentration increase by 10% per micron. When the thickness of the first layer equals to 2 micron, the concentration in the upper portion of the first layer would be 20% (10 % per micron x 2 micron = 20%). Base on this information, the concentration of germanium in the second layer is the same as the concentration of the first layer in the upper portion.

Respect to claim 7, Leitz teaches the second layer is formed to a thickness between 0.2-2  $\mu\text{m}$  (paragraph 0030, overlap with applicant's range). Respect to claims 8-9, 26-27, Thilderkvist teaches to use HCl or HBr etchant to remove silicon germanium layer.

Respect to claim 10, Thilderkvist teaches to use either silicon or silicon germanium film (paragraph 0045). Thilderkvist further teaches the removal amount of this film is about 100 nm (paragraph 0050; Note 100 nm = 0.1 micron). Respect to claims 11-13, 28-29, Thilderkvist teaches to use hydrogen smooth agent at the temperature between 1000-1300 °C, preferably between 1050-1200 °C, 1100 °C to smooth the silicon germanium surface (abstract and paragraph 0045, 0047, 0050).

Respect to claim 14, Thilderkvist fails to explicitly disclose the specific thickness ranges for the silicon layer. However, Thilderkvist clearly teaches the silicon film can be

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formed having any thickness (paragraph 0053). The result effective variable is commonly determined by routine experiment. Thickness is a result effective variable. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal thickness as an expected result.

### ***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*Binh X. Tran*

Binh X. Tran